(19) JAPANESE PATENT OFFICE (JP)

(12) Publication of Unexamined Patent Application (KOKAI) (A)

(11) Japanese Patent Application Kokai Number: **2002-14087(P2002-14087A)**

(43) Kokai Publication Date: January 18, 2002

(51) Int. Cl.[7]	Identification Symbol	F1	Theme Code (reference)
G 01 N 30/54		G 01 N 30/50	D
			F

Request for Examination: Not requested Number of Claims: 1 OL (4 pages total)

(21) Application Number: 2000-197501 (P2000-197501)

(22) Filing Date: June 30, 2000

(71) Applicant: 000001999
SHIMADZU CORPORATION
1, Nishinokyo kuwahara-cho,
Nakakyo-ku, Kyoto-shi, Kyoto

(72) Inventor: Masanao Furukawa
c/o SHIMADZU CORPORATION
1, Nishinokyo kuwahara-cho,
Nakakyo-ku, Kyoto-shi, Kyoto

(74) Agent: 100097892
Yoshiaki Nishioka, Patent Attorney

(54) [Title of the Invention] Gas Chromatograph Oven

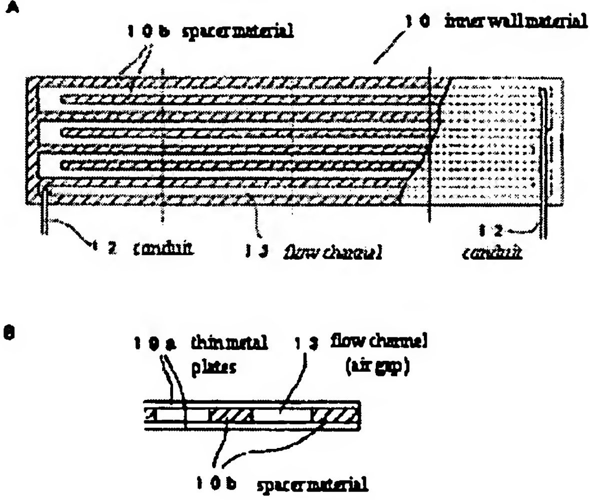
(57) [Summary]

[Object] To reduce the cooling time of an oven in a gas chromatograph for performing programmed temperature gas chromatography.

[Means of Achievement] An oven casing is structured using inner wall material whose interior is provided with a flow channel for a cooling fluid, and air or the like is circulated in this flow channel during cooling. Specifically, inner wall material 10 is structured by sandwiching and hermetically pressure-welding spacer material 10b between two thin metal plates 10a, and the air gap enclosed by these thin metal plates 10a and the spacer material 10b functions as a flow channel for the cooling fluid. The flow channel 13 is formed over the entire surface of the inner wall material 10 so as to turn several times from one corner to the opposite corner at both ends, and a conduit 12 is provided to both ends of the flow channel. The inner wall material thus

structured is bent into a square shape and bonded at both ends, and a back wall is attached to structure an oven casing. When the oven is cooled, air is delivered through the conduit 12, and cooling begins from the inner wall material itself. Combining this with conventional cooling means makes it possible to further reduce cooling time.

A



B

[Claims]

[Claim 1] An oven for accommodating a gas chromatography column in the space inside a casing structured from at least a thermal insulating material and an inner wall material on the inner side thereof, wherein said gas chromatograph oven is characterized in that a wall material comprising flow channel means for a cooling fluid is used as the inner wall material.

[Detailed Description of the Invention]

[0001]

[Technological Field of the Invention] The present invention relates to a gas chromatograph oven, particularly to an oven suitable for use in a gas chromatograph for performing programmed temperature gas chromatography.

[0002]

[Prior Art] A gas chromatograph comprises an oven for heating a column to a specific temperature of analysis. Programmed temperature gas chromatography is a method for analyzing the oven temperature while gradually raising the temperature from a relatively low

level that is close to room temperature (near-room temperature) to a high level of several hundred degrees according to a previously determined program. In programmed temperature gas chromatography it is important to follow the program and to accurately control the temperature, but at the same time it is required that the oven at a high temperature be rapidly cooled to near-room temperature after analysis is complete so that the next analysis can be quickly begun.

[0003] Fig. 3 is a schematic view showing the cooling mechanism in a conventional typical gas chromatograph oven. In the diagram, an oven casing 1 is assembled into a box shape by welding or other such construction methods from structural materials primarily comprising an inner wall material in the form of stainless steel or another metal thin plate; and 2 is a thermal insulating material that covers the casing and is indispensable for maintaining the oven interior at a specific temperature. Furthermore, the outside of the thermal insulating material is commonly covered with an outer wall material that protects the thermal insulating material and improves its appearance, but this is omitted in the diagram.

[0004] A fan 3 in the oven is driven by a motor (not shown) provided to the outer back surface of a tank, and circulates the air in the tank to evenly heat the oven interior. Normally during heating, an intake port 4 and an exhaust port 5 provided to a back wall 11 are closed by a door 6, but when the oven is being cooled, the door 6 is opened to take in cold external air through the intake port 4 and to expel hot air in the tank through the exhaust port 5. The external air is then taken in by the suction force of the fan 3. An intake duct 41 is provided to effectively draw in the air, and the duct is structured such that the air is led by the duct from the intake port 4 to directly behind the fan 3, and is then suctioned into the tank. There are other examples wherein a door 6 is provided separately to both the intake port 4 and the exhaust port 5, but this depends on the arrangement of the intake port 4 and the exhaust port 5, and is not a substantial difference.

[0005] Normally the front surface of the oven casing 1 (left side in the diagram) is provided with a door for inserting and removing a column or the like, and the top portion is provided with a sample inlet part or a detecting system. The oven interior is also provided with a heater and an accessory structure for supporting the heater, but neither of these is directly related to the present invention, and is therefore omitted from the diagram.

[0006]

[Problems That the Invention Is Intended to Solve] With such a structure, after programmed temperature gas chromatography is complete, an oven at a high temperature is cooled to near-

room temperature by cutting off the power to the heater and opening the door 6 to take in cold external air through the intake port 4 and to expel hot air in the tank through the exhaust port 5. Thus, the oven can be cooled from a high temperature of about 400°C to near-room temperature in 5 to 10 minutes, but this cooling time is unproductive in terms of the operating efficiency of the analyzing device and should be reduced as much as possible. Therefore in conventional practice, the intake duct 41 previously described has been provided to increase intake/exhaust efficiency during cooling, and contrivances have been employed such as reducing the thermal capacity using an extremely thin metal plate with a thickness of about 0.4 mm as the inner wall material 1*, but the present situation is that a further reduction of the cooling time is required. The present invention was designed in light of this situation, and an object thereof is to provide a gas chromatograph oven wherein it is possible to further reduce the cooling time.

[0007]

[Means Used to Solve the Above-Mentioned Problems] In the present invention, to solve the above-mentioned problems, the oven casing is structured using an inner wall material provided with a flow channel for cooling fluid in the interior of the material itself. Thus, cooling speed can be increased by circulating air or the like in this flow channel during cooling, and cooling time can be reduced.

[0008]

[Working Examples] A working example of the present invention is shown in Fig. 1. Fig. 1A is a spread-out view of the inner wall material 10 that constitutes the oven casing, which is bent into a square shape at the dotted lines and is fitted with a back wall to form the casing. The inner wall material 10 is structured by sandwiching and hermetically pressure-welding spacer material 10b between two thin metal plates 10a with a thickness of 0.1 to 0.2 mm. Fig. 1B shows a cross-section of part of the inner wall material 10, and as shown in the diagram, it is possible to form an air gap enclosed by the thin metal plates 10a and the spacer material 10b. This air gap functions as the flow channel 13 for cooling fluid to be described below. The spacer material 10b is an elongated thin metal plate that has a thickness of about 0.5 to 3 mm, is disposed so as to border the periphery of the inner wall material 10, and is further disposed so as

* Translator's note: Possible typographical error; "inner wall material" is denoted by the number 10 elsewhere in this patent.

to form a single flow channel 13 that turns many times at both ends from one corner to the opposite corner in the entire interior surrounded by the bordering. Holes are formed in the other thin metal plate 10a as inlets/outlets for fluid in both ends of the turning flow channel, and a conduit 12 is fitted therein by welding or the like.

[0009] The inner wall material 10 thus structured is bent into a square shape and bonded at both ends, and an oven casing is formed nearly identical in appearance to the conventional example shown in Fig. 3 by attaching a back wall. When bending the structure, moderate rounding and bending should be implemented to prevent the flow channel from being crushed in the bent portion. The same manufacturing materials of the inner wall material 10 can be used for the back wall, but as previously described, the back wall has openings (intake/exhaust openings) and is also fitted with a fan, a motor, and other structures, so consideration must be given to arranging the flow channel for cooling fluid such that these structures are circumvented. The present working example is one in which the back wall is made from simple plate metal similar to the conventional example to avoid such complications.

[0010] In the oven of the present invention, cooling from high temperatures is done as follows. First, similar to conventional practice, the power to the heater is cut off while external air is taken in and hot air is expelled through the intake/exhaust opening. At the same time, the inner wall material 10 is cooled from the interior by delivering air into the inner wall material 10 through one of the conduits 12 and expelling it through the other conduit. A separate pump or other such air delivery means may be prepared to deliver the air, but since the gas chromatograph usually comprises an air compressor as a secondary fixture, it is easiest to utilize this fixture to receive a supply of compressed air. As such, air is taken into the oven by the fan 3, and cooling air also flows into the inner wall material 10 itself, whereby the surface area of the structural body of the oven in contact with the cooling air increases and the cooling time markedly decreases.

[0011] Various arrangements can be considered for the flow channel pattern in the inner wall material 10 regardless of the type of folding described above. Fig. 2A shows a pattern of multiple parallel flow channels as an example thereof. Specifically, multiple parallel flow channels can be disposed such that they diverge at one end and converge at the other end, and resistance to circulation becomes low compared to the turning shape in Fig. 1, making it possible to increase the amount of cooling fluid and to improve cooling efficiency. In this pattern, no

adverse effects are produced by side leaks between parallel flow channels, so there is no need to give attention to the airtightness of the bonds other than in the bordering portion, making manufacturing simple. Various other arrangements, though not shown, can be used as the flow channel pattern, particularly a spiral shape, a radial shape, a pattern comprising a combination thereof, or the like.

[0012] Arranging a combination of multiple thin-plate spacer materials 10b to form the flow channel pattern described above hinders operability during manufacturing. Productivity is increased if the patterned spacer material is punched out from a single plate. In order to further increase productivity, a manufacturing method can be proposed wherein one of the thin metal plates 10a is pushed out into a flow channel pattern by press working, and the resulting plate is pressure welded with another flat plate without using the spacer materials 10b. Fig. 2B shows an example of a cross-section of an inner wall material made by such a manufacturing method.

[0013] As described above, the cooling effects can be further increased when a gas or liquid with higher thermal conductivity is used as the cooling fluid in place of air delivered to the interior of the inner wall material. When air is used as the cooling fluid, the outlet side conduit is omitted from the two conduits 12, and only the exhaust duct is opened to directly release the air into the atmosphere after cooling, thus making it possible to simplify the structure.

[0014]

[Effect of the Invention] As described in detail above, the present invention makes it possible to improve cooling speed and to reduce cooling time by the combined use of a conventional oven cooling mechanism because the oven cooling is facilitated by providing a flow channel for fluid to the interior of the inner wall material itself (which is a structural material of the oven) and by circulating air or another such cooling fluid in this flow channel during cooling. As a secondary effect, the weight of the oven can also be reduced because the interior of the wall material has air gaps.

[Brief Description of the Drawings]

[Figure 1] A diagram showing a working example of the present invention

[Figure 2] A diagram showing a variation of the present invention

[Figure 3] A diagram showing the structure of a conventional gas chromatograph oven

[Explanation of Symbols]

1: oven casing

2: thermal insulating material

3: fan

4: intake port

5: exhaust port

6: door

10: inner wall material

10a: thin metal plates

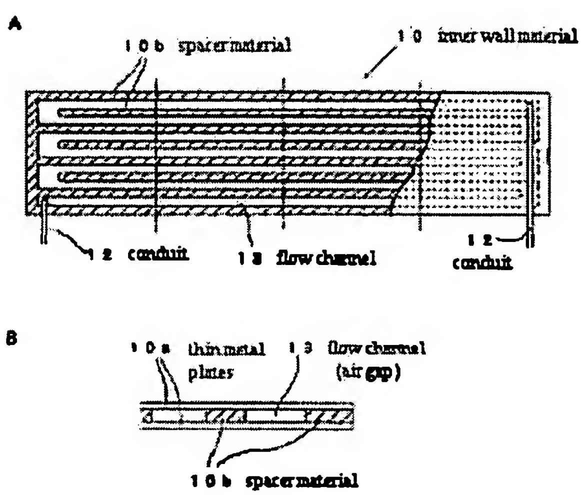
10b: spacer material

11: back wall

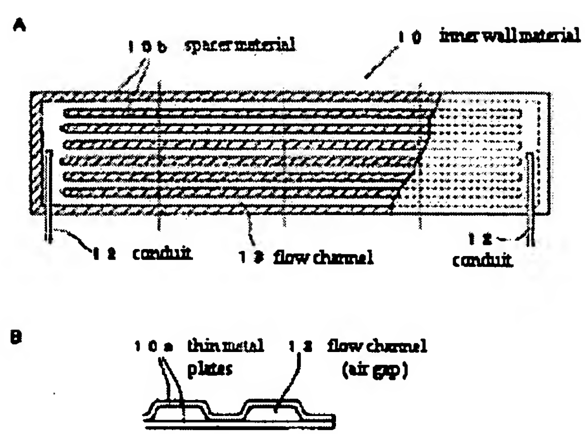
12: conduit

13: flow channel

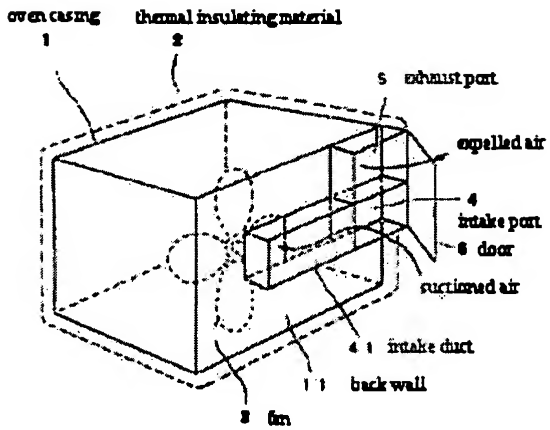
[Fig. 1]



[Fig. 2]



[Fig. 3]


oven casing
1
thermal insulating material
2
5 exhaust port
expelled air
4
intake port
6 door
suctioned air
41 intake duct
11 back wall
3 fan